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IN THE U.S. PATENT AND TRADEMARK OFFICE

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Applicant	:	Sebire, et al.
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Title	:	MOBILE EQUIPMENT BASED FILTERING FOR PACKET RADIO SERVICE

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S APPEAL BRIEF

Sir:

The Applicant/Appellant hereby submits this APPEAL BRIEF to the Board of Patent Appeals and Interferences. Enclosed is a draft in the amount of $620 which includes a one month time extension. Should the undersigned attorney be mistaken as to time or fees, please consider this a petition for an additional extension of time under 37 C.F.R. § 1.136(a) or (b) that may be required to avoid dismissal of this appeal, and debit Deposit Account No. 50-1924 as appropriate.

(1) REAL PARTY IN INTEREST

The real party in interest (RPI) is Nokia Corp of Espoo, Finland; parent company of the Assignee Nokia Mobile Phones, Ltd.

(2) RELATED APPEALS AND INTERFERENCES

There are no other pending appeals or interferences of which the undersigned representative and Applicant/Appellant is aware that will directly affect, be directly affected by or have a bearing on the Board's decision in this appeal.

(3) STATUS OF CLAIMS

Claims 1-20 are pending in this appeal, and are reproduced in an Appendix accompanying this Brief as those claims stood finally rejected by a final Office Action dated December 14, 2005.

This application was filed on December 9, 1999 with twenty claims. In response to an Office Action dated June 15, 2006, the Applicant amended claims 1, 4-10, 17 and 19. In response to a final Office Action dated December 14, 2005, the Applicant filed a Response (after final rejection) dated March 8, 2006, which made arguments but no amendments to the claims. An Advisory Action dated April 6, 2006 recited that the Response (after final rejection) was considered but did not place the application in condition for allowance. The claims as finally rejected are reproduced in an Appendix hereto (section 8).

(4) STATUS OF AMENDMENTS

No amendment to the claims was proposed or entered subsequent to the final Office Action dated December 14, 2005.

(5) SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed toward determining an indication of link quality experienced by mobile equipment ME, such as a mobile radiotelephone operating in a wireless network. The network sends, and the ME receives, an indication of the ME's speed. The ME calculates an indication of link quality that it experiences, and that calculation uses a finite-length filter whose length is a function of the received speed indication. Once calculated, the ME reports the calculated indication of link quality to the wireless network. Independent claims relate to a method for operating the ME (claim 1); a wireless communication system that includes both the wireless network and at least the one ME (claims 17 and 19); and a method for operating the wireless communication system (claim 20). Dependent claims detail specifics as to how the speed indication is reported to the ME (claims 3-10); how the received speed indication is used to determine the filter length (claims 11-14, of which claims 13-14 also specify how another parameter that influences filter length is reported to the ME and an interchange between that another parameter and the ME speed indication); and specifics of the calculation of link quality apart from the received speed indication (claims 15-16, 18).

As described in the background section of the application, different MEs within the same serving cell may encounter different channel conditions and fading effects, some of which are related to the speed of the different MEs. (page 4 line 5-9). An object of the invention is to provide a technique for filtering in the ME that accounts for interference effects change due to the speed of the ME. (page 4 lines 21-28). Specifically, the length of a filter is changed, such as by changing a forgetting factor "a", in the ME itself. (page 13-22). The speed of the ME is incorporated into filter calculations for link quality (page 7 lines 2-

5). For example, a lower ME speed results in filtering over a longer period of time (e.g., using a smaller forgetting factor), and a higher ME speed results in filtering over a shorter period of time (e.g., using a larger forgetting factor). (page 7 lines 5-13). The ME speed indication (e.g., ME_SPEED parameter) used to determine the filter length is particular to the subject ME, and is received from the network. (page 9 lines 19-28, page 10 lines 5-9).

Specific to the claims, the elements of method claim 1 are detailed as follows:

wirelessly receiving at a mobile equipment ME an indication of the ME's speed through a wireless network (page 8 lines 27-32; page 9 lines 19-28; page 10 lines 5-7; and page 11 lines 19-20);

calculating in the ME an indication of link quality experienced by the ME, the calculation employing a filter having a finite filter length that is a function of the speed indication (page 10 lines 10-21; and page 12 lines 16-18); and

reporting the calculated indication of link quality to the wireless network (page 13 lines 6-8).

The point-to-point message of dependent claim 2 is described at page 11 lines 13-16; the padding bits of claims 4, 8 is detailed at page 11 line 33 to page 12 line 11; the Packet Associated Control Channel PACCH of dependent claims 5-8 is detailed at page 11 lines 13-19; the Packet System Identification 13 message (PSI13) of dependent claims 6-8 is detailed at page 11 line 21 to page 12 line 5; the modifying, calculating, and replacing of dependent claims 11-14 as well as the broadcast message of dependent claims 13-14 are detailed at page 12 lines 16-35; the derivative of ME speed of dependent claim 15 is described at page 11 lines 13-14; and the bit error probability (BEP) or coefficient of BEP (cv BEP) of dependent claims 16 and 18 are described at page 10, lines 11-19. Each of these claims recite in plain language and need no further explanation of terms.

Independent method claim 20 is similar to method claim 1, but recites determining and transmitting elements by the network whereas claim 1 recites only actions performed by the ME. Further, rather than specifying ME speed as in claim 1, claim 20 recites that the network determines an indication of signal quality experienced by individual ones of a plurality of MEs, transmits using a point-to-point message, and that the ME uses the received indication of link quality for setting a filter length that operates on a sequence of link quality measurement data. Claim 1 does not recite a sequence. Support for these claim 20 elements may be found at page 6 lines 5-8 (mean BEP or cv of the BEP, like claim 16).

Independent apparatus claim 19 also recites padding bits, a PSI13 message, and a PACCH as in claim 8.

Respecting the independent apparatus claims 17 and 19, the various elements are supported and described as follows. In the wireless network (12), the unit for deriving the indication of a speed of the ME may be a data processor of a base station controller (BSC 26) and the transmitter and receiver are components of the transceiver (base station transceiver BTS 22), as described at page 9 lines 5-6 and 19-23 and shown in Figure 3. In the ME, the receiver (18B), processor (controller 14 such as a combination microprocessor and digital signal processor DSP) for implementing a filter (16C) for filtering a sequence of link quality measurement data (16A), and the transmitter (18A) are described at page 8 line 18 to page 9 line 1 and shown in Figure 3.

Apparatus claim 17 differs from method claim 1 in that method claim 1 recites elements specific to the ME, whereas claim 17 recites elements of both the network and the ME. Apart from reciting network elements, the ME elements of apparatus claim 17 recite in apparatus similar functions as the method elements of claim 1.

Apparatus claim 19 distinguishes over claim 17 in that claim 19 recites that the network transmitter transmits the indication of the ME speed by using a plurality of bits placed into padding bits of a PSI13 message sent on the PACCH, whereas neither of claims 1 or 17 are specific as to bits or channel.

(6) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Issue A. Claims 1, 3 and 11-17 stand rejected under 35 U.S.C. § 102(e) as anticipated by Jin (U.S. Pat. No. 6,658,045).

Issue B. Claims 4 and 6-10 stand rejected under 35 U.S.C. § 103(a) as obvious over the teachings of Jin, with no other references apart from ordinary skill in the art cited.

Issue C. Claims 5 and 19 stand rejected under 35 U.S.C. § 103(a) as obvious over the combination of Jin with a paper entitled "EPGRS Link Quality Control Measurement and Filtering", ETSI SMG2 Working Session on EDGE, Tdoc SMG2 EDGE 444/99 (October 18-22, 1999), hereinafter the ETSI reference.

Issue D. Claim 20 stands rejected under 35 U.S.C. § 103(a) as obvious over the combination of Wan (US Pat. No. 6,385,460) with the ETSI reference.

Issue E. Claim 18 stands rejected under 35 U.S.C. § 103(a) as obvious over the combination of Jin with Wan.

(7) ARGUMENT

In the arguments below, claims argued separately are deemed not to fall with other claims in the group.

Issue A. ANTICIPATION OF CLAIMS 1, 3 AND 11-17 BY JIN:

Claim 1: Independent method claim 1 recites in relevant part:

calculating in the ME an indication of link quality experienced by the ME, the calculation employing a filter having a finite filter length that is a function of the speed indication; and

reporting the calculated indication of link quality to the wireless network.

The Appellants assert that Jin fails to disclose this claim element.

Independent apparatus claim 17 stands or falls with claim 1. All dependent claims under Issue A are argued separately.

Jin is directed to a CDMA system that improves performance by virtue of being adaptive to the speed of the mobile unit, for which a speed estimator may be located in the base station or the mobile unit (abstract). The base station calculates a reverse power control value REV_PWR_CTRL using the mobile unit's SPEED parameter and sends that REV_PWR_CTRL value to the mobile unit. (col. 10 lines 19-27). The base station may also send the SPEED parameter to the mobile unit. (col. 3 lines 10-15).

Jin uses this Speed parameter for several calculations in the mobile unit, including in a channel state information (CSI) estimator (col. 2 lines 37-43). The CSI estimator 130L "essentially consists of a variable length accumulator and a normalizer, for summing the

sample stream $Y_I(L)$ and normalizing it according to the length of the accumulation period. The accumulation period is specifieable by the value of SPEED,..." (col. 6 lines 15-20). But Jin never reports this CSI estimate to the network. "The output of the CSI estimator 130L, denoted FNGR_STRN(L), is a measurement of the actual strength of a multipath path being tracked by finger 80L, and is fed to both the control unit 90 and to the diversity combiner 150." (col. 6 lines 23-27, see also col. 9 lines 7-13). The diversity combiner weights the I and Q sample streams by the value of FNGR_STRN(L), sums the in-phase products to yield sample streams 10I and 10Q, which are fed to the baseband processing block 160. (col. 6 lines 40-53, col. 9 lines 14-20). "The baseband processing block 160 processes the baseband sample streams 10I, 10Q produced by the diversity combiner 150 and a voice or data signal is *delivered to the user*." (col. 9 lines 22-25, emphasis added). The output of Jin's CSI estimator 130L is not seen to be used in any indication that Jin reports back to the network.

The remarks in the Advisory Action indicate that the Examiner considers Jin's forward power control value FWD_PWR_CTRL as anticipating the "indication of link quality" that claim 1 above recites as being reported to the wireless network. The FWD_PWR_CTRL parameter is sent to the base station in Jin (col. 9 lines 58-63). This is seen to fail to anticipate claim 1 for two reasons: it is not calculated employing a filter length that is a function of the mobile equipment's speed indication, and it is not an indication of link quality.

First, calculation of neither Jin's PWR_CTRL_THR (a threshold) nor FWD_PWR_CTRL parameters employ a variable length filter. The PWR_CTRL_THR parameter is extracted from a look-up table indexed according to SPEED. (col. 9 lines 45-47). The FWD_PWR_CTRL parameter is a difference between an accumulated value and the PWR_CTRL_THR value (col. 9 lines 51-53). The accumulated value is the product of FNGR_STRN(L) and COMB(L) parameters, summed and accumulated over a given period. (col. 9 lines 36-45). The *given* period is set by a standard ["(e.g., 1.25 ms as in IS-95)"] and the example shows that the period is fixed, so the period over which those parameters are accumulated appears unrelated to the SPEED parameter. Calculation of either the PWR_CTRL_THR or the FWD_PWR_CTRL parameters are not reasonably seen to anticipate employing a filter whose length is a function of a speed indication as in

claim 1. Claim 1 does not merely recite that the indication of link quality depends from the mobile's speed indication; it recites that the filter length is a function of the speed indication.

Second, Jin's FWD_PWR_CTRL value is not seen to reasonably be analogous to an indication of link quality. As noted above, Jin discloses a CSI estimator 130L that estimates channel state information, but that estimate is not reported to the network. Jin explicitly states "As previously discussed, the value FWD_PWR_CTRL is then sent back to the base station, which will increase (decrease) the transmitted power if the FWD_PWR_CTRL is negative (positive), ..." (col. 9 lines 58-62).

The written description explicitly provides that power control is distinct from link quality at page 13 line 29 to page 14 line 6:

> "It should again be noted that *other* uses for the ME_SPEED parameter may exist in the ME 10, *such as for power control* and handover purposes. Furthermore, the ME-based optimized filtering method *for link quality (LQ) channel measurements mad[e] possible by the teachings of this invention* can be used for several purposes in real-time EGPRS, such as for mapping some given quality of service (QoS) to some modulation scheme (e.g., for speech, streaming video, etc.)" (emphasis added)

The written description clearly indicates that a power control indication is separate and distinct from the claimed "indication of link quality". Claim terms cannot be read so broadly as to encompass what the written description accompanying and enabling those claims explicitly recites is different from the claimed term, as above.

<u>Claim 3</u> depends from claim 1, and recites "*wherein the step of receiving uses a point-to-point message.*" Jin discloses that the speed of the mobile unit may be measured at the base station and transmitted to the mobile unit as a control message (col. 7 lines 31-35), but fails to disclose any further particulars as to that control message. No disclosure in Jin is seen that the speed estimate may be sent to the mobile using a point-to-point message.

Dependent claims 11-14 recite respectively that the speed indication is used to modify (claims 11 and 13), calculate (claim 12) or replace (claim 14) a forgetting factor that influences the length of the filter. The forgetting factor is exemplified at page 7 lines 13-19 and page 10 line 11 to page 11 line 1 as the variable "a", which takes values between zero and one. Jin does not disclose a forgetting factor, either calculated from the speed indication or modified from it.

Dependent claims 13-14 recite that the forgetting factor (modified in claim 13 and replaced in claim 14) is received in a broadcast message from the wireless network. Jin discloses that the speed of the mobile unit may be measured at the base station and transmitted to the mobile unit as a control message (col. 7 lines 31-35), but fails to disclose any further particulars as to that control message. No disclosure in Jin is seen respecting a forgetting factor, let alone that the network provide that forgetting factor to Jin's mobile unit in a broadcast message.

Dependent claim 15 recites that the step of calculating takes into account a derivative of a speed of the mobile equipment. The first derivative of speed with respect to time is acceleration. Jin is not seen to disclose acceleration, or any other derivative of speed, in any of its disclosure.

Dependent claim 16 recites:

wherein the step of calculating operates on a plurality of measurements of one of a mean Bit Error Probability (BEP) or a coefficient of variation of a Bit Error Probability (cv)(BEP).

Jin's only disclosure related to BEP or cv BEP is seen to be: "rather than calculating the received signal strength by linearly combining the received finger strengths, any other type of intermediate power control criterion that is a monotonic function of frame error rate or bit error rate can be used to compare with FWD_PWR_THR." (col. 9 line 64 to col. 10 line 1). Note that Jin discloses BER rather than BEP. The application clearly shows in the equation at page 10 that C_n can be mean BEP or cv BEP.

Issue B. OBVIOUSNESS OF CLAIMS 4 AND 6-10 OVER JIN:

Dependent claim 4 is not argued separately since the Examiner has taken official notice of the subject matter of claim 4. Claim 4 stands or falls based on the Board's determination as to whether Official Notice of that subject matter is proper or not. Claim 4 further stands if claim 1, from which it depends, is allowed over Jin, since the distinctions of Jin argued above under issue A are neither obvious nor asserted as being obvious in the final rejection.

The Examiner has also taken Official Notice as to the subject matter of claims 6-10. The propriety of that Official Notice is argued below.

Dependent claim 6 recites:

wherein the indication of ME speed comprises a message received in a Packet System Identification 13 (PSI13) message received on a Packet Associated Control Channel (PACCH).

Dependent claims 7-8 also recite this same element, with additional variances, and stand or fall with claim 6. As stated at page 11 lines 26-27, the PSI13 message is described in a GSM standard. Jin explicitly relates his disclosure to IS-95 or 3G CDMA, which are different standards than GSM. One of ordinary skill would not look to Jin as to how to modify a specific message of the GSM standard.

Dependent claim 9 recites:

wherein indication of ME speed comprises a plurality of bits for indicating a plurality of speed subranges of a speed range.

Claim 10 adds further detail to this element of claim 9 (four bits, 16 speed subranges). Recall that independent claim 1 recites that the indication of ME speed is received from the network. Recall also that Jin, as detailed above with respect to claim 1, uses the received SPEED value for multiple computations, including a tracking loop of a PN code despreader (col. 4 lines 58-61 and col. 5 lines 14-21); setting the accumulation period of the I and Q accumulators (col. 5 line 65 to col. 6 line 3); and normalizing the length of the accumulator for the CSI estimator (col. 6 lines 14-20), which may also be used for phase estimation (col. 5 lines 54-58). Regardless of whether it or not the Official Notice of

sending speed subranges is known, such an adaptation of Jin does not appear proper as it is not seen that a single speed sub-range, sent by the network, would properly resolve all of these various computations in Jin. It is also not obvious to modify Jin to provide in some instances an actual speed estimate for the above calculations, and a speed range that might render obvious claims 9-10, because in such an instance the speed range is repetitive of more detailed information the mobile unit would already possess and therefore represent bandwidth used for no necessary purpose. Claims 9-10 are seen as non-obvious despite the Official Notice.

Issue C. OBVIOUSNESS OF CLAIMS 5 AND 19 OVER JIN AND THE ETSI REFERENCE:

Dependent claim 5 recites:

wherein the step of receiving uses a message received on a Packet Associated Control Channel (PACCH).

The ETSI reference relates to the EGPRS system. Jin explicitly relates his disclosure to IS-95 or 3G CDMA, which are different standards than GSM. One of ordinary skill would not modify Jin's disclosure for IS-95 or 3G CDMA with teachings for specific channels of an EGPRS standard.

Claim 19 is an independent apparatus claim, which recites similar to claim 17 but with the below italicized difference:

a transmitter for transmitting the indication of the ME speed to the ME *by using a plurality of bits placed into padding bits of a Packet System Identification 13 (PSI13) message sent on a Packet Associated Control Channel (PACCH)*;

First, the ETSI reference teaches using a packet system information 1 message, which is broadcast. (ETSI reference, page 11). Claim 19 recites a PSI13 message. Second, the

ETSI reference is not seen to cure the above deficiencies of Jin, which are recited in claim 19 as:

implementing a filter for filtering a sequence of link quality measurement data, said filter having a finite filter length that is a function of said received transmitted speed indication; and

a transmitter for transmitting an indication of said filtered link quality measurement data to the receiver of said wireless network.

Note that unlike claim 17, claim 19 recites filtering *a sequence of link quality measurement data* with a filter having a filter length that is a function of the received speed indication, and transmitting *an indication of said filtered link quality measurement data* to the network. The rejection cites only Jin for these elements. The argument presented above respecting claims 1 and 17 is repeated for claim 19. Whereas the ETSI reference discloses separately filtering for a sequence of blocks in the mobile (page 11), it is not seen how this teaching may be adapted to Jin's FWD_PWR_CTRL, which is a binary value instructing the base station to adjust its transmitted power up or down. (col. 9 lines 54-63). Filtering a *sequence* of Jin's FWD_PWR_CTRL values would still leave only a single instruction to the network to increase or decrease its transmit power, else Jin's principle of operation for forward power control is violated. Determining that instruction from a *sequence* of FWD_PWR_CTRL values is seen to be less accurate for power control, as the forward power control instructions would then be averaged over a period of time rather than responsive to power of a most-recent received signal. Such a modification would render the Jin base station less responsive to the received signal power at the Jin mobile unit than Jin's disclosed approach. A power control loop modified in that way would always lag in time the power control instructions most appropriate to Jin's present circumstances of received signal power.

Issue D. OBVIOUSNESS OF CLAIM 20 OVER WAN AND THE ETSI REFERENCE:

The elements of independent claim 20 recite (with alphabetical indicators added here for brevity of discussion):

(a) *determining in the wireless network an indication of a signal quality experienced by individual ones of the plurality of ME;*

(b) *transmitting the determined indications to individual ones of the ME using a point-to-point message;*

(c) *in a particular one of the plurality of ME, receiving the transmitted indication;*

(d) *using the received indication for setting a finite length of a filter that operates on a sequence of link quality measurement data; and*

(e) *transmitting data from the filter to the wireless network*

As an initial matter, the citations to Wan clearly indicate that it is directed to a method for measuring signal quality from *neighboring* cells in the mobile station, of which that signal quality is expressed through a combination of various indicators (see for example Wan at the abstract, Figures 2 and 5, col. 1 lines 59-61, and col. 7 lines 28-34). Wan teaches at col. 7 lines 23-26 that the signal quality (from a neighboring cell) is averaged in order to tackle the influence of various factors on the measured signal quality. It is notable that Wan does not disclose how this averaging might be accomplished.

Because Wan is directed to measuring at the mobile station signal quality from neighboring cells, it is not seen how Wan teaches a method of determining *in a wireless network* an indication of a signal quality experienced by individual ones of the plurality of ME, as recited in claim 20 (element a above). The cited teachings of Wan describe a mobile unit that itself detects a signal quality for signals received from a neighboring cell. It is not seen how a Wan neighboring cell could determine signal quality experienced by a mobile unit that is, by definition a "neighboring cell", operating outside that neighboring cell! Wan does not disclose how such a result might be achieved, and it is not seen as within ordinary skill in the art given the teachings of Wan.

Since Wan does not teach determining in the wireless network an indication of a signal quality experienced by individual ones of the plurality of ME, then Wan necessarily cannot teach *transmitting the determined indications* to individual ones of the ME using a point-to-point message, as also recited in claim 20 (element b). Note that antecedent

basis in this claim element refers back to the indication of signal quality that was determined in the wireless network. Wan describes at col. 2, lines 20-65 that the mobile unit measures signal quality; col. 5, lines 5-15 explicitly refer to a mobile unit; col. 12, lines 12-65 of Wan refers to actions performed in the mobile unit; and col.7, line 27-col. 8 line 40 of Wan also describes the mobile unit determining signal quality.

None of those citations are seen to teach or suggest transmitting any sort of indications transmitted to individual ones of the ME using a point-to-point message. Nowhere does Wan teach or suggest that an indication is sent to an ME by a base station or other network entity using a point-to-point message.

Because Wan detects signal quality at the mobile station itself, the Wan network does not determine an indication of signal quality experienced by individual ones of the plurality of ME, and so cannot transmit information that it does not have for an individual ME to receive.

The ETSI reference does not disclose a mechanism to use the received indication (of signal quality experienced by individual ones of the plurality of ME) for setting a length of a filtering operation that operates on a sequence of link quality measurement data. Specifically, the ETSI reference states on page 11, §5, "As widely used for other filtering purposes in GSM, a simple parameterised exponential filter could be used. *The filter is characterized by its averaging period (or equivalently its forgetting factor). This parameter should be broadcast in the cell, ...*". (italics added)

The ETSI reference thereby discloses that the averaging *period* of the filter is *broadcast* by the network in the entire cell. This is seen as far afield of the claimed "using the received indication (of signal quality experienced by an individual ME, received in the point to point message) for setting a length of a filtering operation [...]. First, it is the averaging period that mobile units of the ETSI reference receive, not an indication of signal quality experienced by an individual ME as in claim 20 (element c). Second, the ETSI reference *broadcasts* that averaging period, so even that averaging period is not transmitted to individual ones of the ME using a point-to-point message as in claim 20 (element b).

Issue E. OBVIOUSNESS OF CLAIM 18 OVER JIN AND WAN:

Dependent system claim 18 recites:

wherein link quality measurement data is comprised of one of a mean Bit Error Probability (BEP) or a coefficient of variation of Bit Error Probability (cv)(BEP).

As detailed above with respect to claim 16, Jin discloses BER but not mean BEP or cv BEP. Wan also discloses only BER. (col. 7, table 1). The combination of Jin with Wan fails to teach or suggest bit error probability BEP.

Pursuant to 35 USC 41.37, a CLAIMS APPENDIX, EVIDENCE APPENDIX, and RELATED PROCEEDINGS APPENDIX follow the certificate of mailing below.

For at least the above reasons, the Appellants contend that Jin, Wan and the ETSI reference, alone or in combination with one another or ordinary skill in the art, anticipate or render obvious any of the twenty claims argued above. The Appellants respectfully requests the Board reverse the final rejection in the Office Action of December 14, 2005, and further that the Board rule that the pending claims are patentable over the cited art.

Respectfully submitted:

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

9-8-06
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Ann O. Krentowicz
Name of Persona Making Deposit

(8) CLAIMS APPENDIX

1.(Previously Presented) A method for operating a mobile equipment (ME) in a wireless network, comprising steps of:

wirelessly receiving at a mobile equipment ME an indication of the ME's speed through a wireless network;

calculating in the ME an indication of link quality experienced by the ME, the calculation employing a filter having a finite filter length that is a function of the speed indication; and

reporting the calculated indication of link quality to the wireless network.

2. (Canceled)

3.(Previously Presented) A method as in claim 1, wherein the step of receiving uses a point-to-point message.

4.(Previously Presented) A method as in claim 1, wherein the step of receiving places the speed indication in padding bits of a point-to-point message.

5.(Previously Presented) A method as in claim 1, wherein the step of receiving uses a message received on a Packet Associated Control Channel (PACCH).

6.(Previously Presented) A method as in claim 1, wherein the indication of ME speed comprises a message received in a Packet System Identification 13 (PSI13) message received on a Packet Associated Control Channel (PACCH).

7.(Previously Presented) A method as in claim 1, wherein the indication of ME speed comprises a plurality of bits in a Packet System Identification 13 (PSI13) message received on a Packet Associated Control Channel (PACCH).

8.(Previously Presented) A method as in claim 1, wherein the indication of ME speed comprises a plurality of padding bits of a Packet System Identification 13 (PSI13) message received on a Packet Associated Control Channel (PACCH).

9.(Previously Presented) A method as in claim 1, wherein indication of ME speed comprises a plurality of bits for indicating a plurality of speed subranges of a speed range.

10.(Previously Presented) A method as in claim 1, wherein the indication of ME speed comprises four bits for indicating 16 speed subranges within a speed range.

11.(Previously Presented) A method as in claim 1, wherein the speed indication is used to modify a forgetting factor that influences a length of a filter that operates on link quality measurement data.

12.(Previously Presented) A method as in claim 1, wherein the speed indication is used to calculate a forgetting factor that influences the length of the filter that operates on link quality measurement data.

13.(Previously Presented) A method as in claim 1, wherein the speed indication is used to modify a forgetting factor that is received in a broadcast message from the wireless network, the forgetting factor influencing the length of the filter that operates on link quality measurement data.

14.(Previously Presented) A method as in claim 1, wherein the speed indication is used to replace a forgetting factor that is received in a broadcast message from the wireless network, the forgetting factor influencing the length of the filter that operates on link quality measurement data.

15.(Original) A method as in claim 1, wherein the step of calculating takes into account a derivative of a speed of the ME.

16.(Original) A method as in claim 1, wherein the step of calculating operates on a plurality of measurements of one of a mean Bit Error Probability (BEP) or a coefficient of variation of a Bit Error Probability (cv)(BEP).

17.(Previously Presented) A wireless communications system comprised of a wireless network and at least one mobile equipment (ME) located in a serving cell of said wireless network,

wherein the wireless network comprises:

a unit for deriving an indication of a speed of an ME within a serving cell of the network;

a transmitter for transmitting the indication of the ME speed to the ME; and

a receiver;

and wherein the ME comprises:

a receiver for receiving said transmitted speed indication;

a processor for implementing a filter for filtering a sequence of link quality measurement data, said filter having a finite filter length that is a function of said received transmitted speed indication; and

a transmitter in said ME for transmitting an indication of said filtered link quality measurement data to a the receiver of said wireless network.

18.(Original) A wireless communications system as in claim 17, wherein link quality measurement data is comprised of one of a mean Bit Error Probability (BEP) or a coefficient of variation of Bit Error Probability (cv)(BEP).

19.(Previously Presented) A wireless communications system comprised of a wireless network and at least one mobile equipment (ME) located in a serving cell of said wireless network,

wherein said wireless network comprises:

a unit for deriving an indication of a speed of a ME within a serving cell of the network;

a transmitter for transmitting the indication of the ME speed to the ME by using a plurality of bits placed into padding bits of a Packet System Identification 13 (PSI13) message sent on a Packet Associated Control Channel (PACCH); and

a receiver;

and wherein the ME comprises:

a receiver for receiving said transmitted speed indication;

a processor for implementing a filter for filtering a sequence of link quality measurement data, said filter having a finite filter length that is a function of said received transmitted speed indication; and

a transmitter for transmitting an indication of said filtered link quality measurement data to the receiver of said wireless network.

20.(Previously Presented) A method for operating a wireless communications system comprised of a wireless network and a plurality of mobile equipment (ME) located in at least one serving cell of said wireless network, comprising steps of:

determining in the wireless network an indication of a signal quality experienced by individual ones of the plurality of ME;

transmitting the determined indications to individual ones of the ME using a point-to-point message;

in a particular one of the plurality of ME, receiving the transmitted indication;

using the received indication for setting a finite length of a filter that operates on a sequence of link quality measurement data; and

transmitting data from the filter to the wireless network.

END OF CLAIMS

(9) EVIDENCE APPENDIX

Attached please find copies of Jin, Wan, and the ETSI reference relied upon by the Examiner in the final rejection.

(10) RELATED PROCEEDINGS APPENDIX

Section (2) above recites that there are no related proceedings, so this appendix is intentionally left blank.

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Tdoc SMG2 EDGE 444/99
Agenda item 6.3

EGPRS Link Quality Control Measurements and Filtering

1 Introduction

A key issue of the Link Quality Control (LQC) for EGPRS is the link quality measurements made by the mobile stations. These measurements are important in several ways:

- If the mobile is out of memory and can thus not use incremental redundancy (IR) combining, it will have to operate in link adaptation (LA) mode. The choice of modulation and coding scheme (MCS) will directly rely on reported measurements.
- In IR operation, the delay can be controlled by adapting the initial MCS. This adaptation will rely on the same measurements.
- Even in IR operation it is important to be able to detect when the channel conditions are severe, e.g. when the time dispersion is large and/or the velocity is high. In some of these cases it might be better to use GMSK and/or more initial coding then what would otherwise be the strategy.

A filter and reporting ranges for the measured parameters are proposed, as well as a reporting format in the uplink control blocks.

The document also contains a proposal on how to manage the estimation of the performance of the modulation not used.

The document has been updated with a deeper analysis of the proposed measures. It is also shown that the mapping from the proposed measures to BLER is very similar for various channel situations.

In order to complete a CR for 05.08, ranges for the measurement filter parameter and accuracy requirements for the BEP measurements must be agreed on.

2 Proposed Measures

The measures should reflect the following aspects:

- C/I
- Time dispersion
- Velocity
- Frequency hopping

The first three aspects will impact the raw bit error rate (BER), and the latter two will impact the interleaving gain and hence also the choice of MCS.

To cover these aspects it is proposed that the raw bit error probability (BEP) is used as measure. The BEP should be estimated on a burst basis. For each radio block there will hence be four BEP values. From these four values two parameters are derived:

- mean(BEP), i.e. the mean of the four BEP estimates giving the average BEP of a radio block. In the sequel, this will be referred to as MEAN_BEP.

- std(BEP)/mean(BEP), i.e., the coefficient of variation of the four BEP estimates within the radio block. This measure is preferred over the earlier proposed std(BEP) since the range of possible values of std(BEP)/mean(BEP) depends less on mean(BEP), and thus the range of the measure is better utilised. This will be denoted CV_BEP in the rest of the document.

MEAN_BEP describes the impact of the C/I, time dispersion and velocity. CV_BEP describes how the channel quality varies from burst to burst, and can hence be used to reflect interleaving gains/losses (depending on the coding scheme) caused by velocity and frequency hopping.

It is in order to obtain CV_BEP that the BEP has to be estimated on burst basis, i.e. a long term BER estimate can not be used. The BEP estimates should cover the range 50% to very low values and hence it is not enough to estimate the BER event for a burst since it is too short. Additionally it is the expected performance for the next blocks that is of interest, and hence it is actually the expected BER for such a channel, i.e. the BEP, and not a BER event for a single burst that should be estimated.

2.1 Estimating the BEP

The BEP may for instance be estimated during the demodulation process using soft output from the receiver. Notice that the estimation algorithm, as other receiver algorithms, is implementation specific and should not be standardised. Performance requirements on the estimation however need to be standardised to ensure overall system performance. A proposal for accuracy testing is given in [2].

In the left part of Figure 1, the relation between the average BER and the estimated BEP is depicted under different conditions. A simple estimation algorithm was used. As can be seen, the BEP estimates can handle time dispersion. This would not be the case if only C/I oriented estimates were made, as can be seen in the right part of Figure 1. In these simulations the burst BEP is estimated from the C/I assuming a TU3 channel. Of course this does not work at all for other channels, and should be seen as an illustration to why C/I based estimates can not be used.

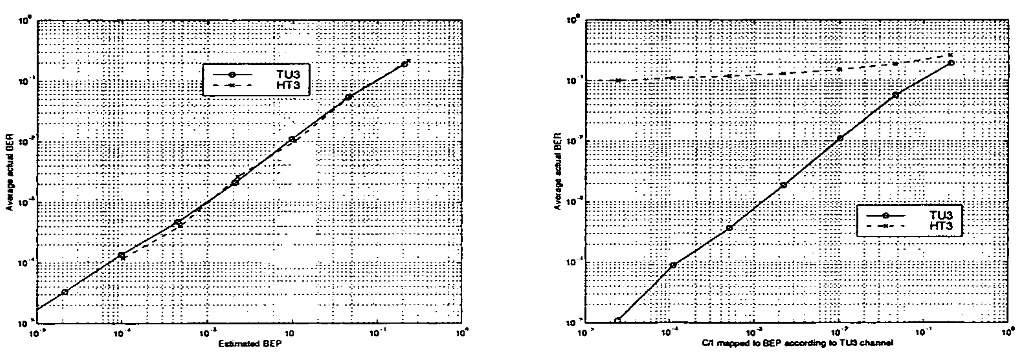

Figure 1. Left: BEP estimates for different channel cases. The estimates follow the average BER nicely, showing that time dispersion is correctly reflected in the link quality estimates. Right: C/I based BEP estimates for different channel cases. The burst C/I estimates are mapped to equivalent BEP assuming a TU3 channel. Obviously the HT3 performance is heavily overestimated.

2.2 Mapping to BLER and Throughput

The mapping from MEAN_BEP and CV_BEP to throughput is depicted in Figure 2 for GMSK and in Figure 3 for 8PSK. Note that both parameters have impact on the appropriate switching limits.

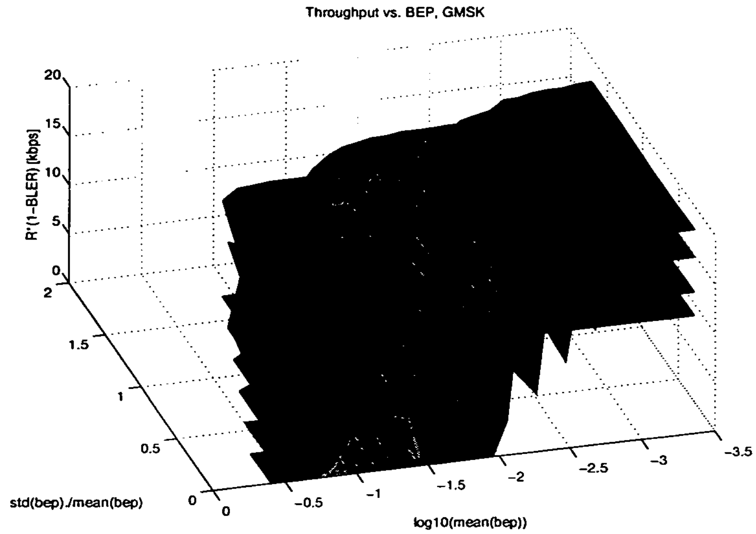

Figure 2. Throughput for MCS-1 to MCS-4 as a function of MEAN_BEP and CV_BEP. Note that the switching points rely on both parameters.

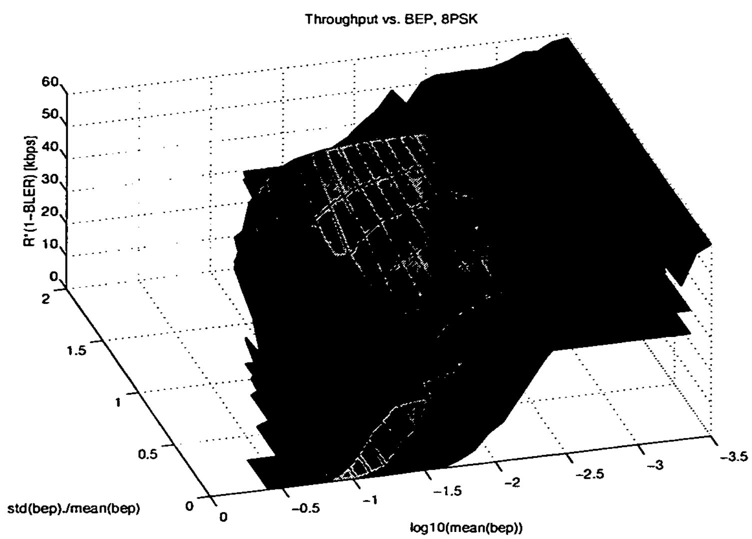

Figure 3. Throughput for MCS-5 to MCS-9 as a function of MEAN_BEP and CV_BEP. Note that the switching points rely on both parameters.

Concerns have been raised [5] about the behaviour of the throughput in Figure 2 and Figure 3 when the CV_BEP increases. Since more robust codes should gain more from interleaving than weak ones, one could expect that the switching limits would bend the other way. It was feared that this is due to some unwanted property of the CV_BEP. But this is rather due to the way MEAN_BEP is defined: the logarithm of the linear mean of the burst BEP estimates. Consider a radio block where

MEAN_BEP $= \log_{10}(\text{mean(BEP)}) = a$

From this follows that all four bursts has a BEP less than

$\max(\text{BEP}) = 4 \cdot 10^{a}$

Or equivalently

$\log_{10}(\mathrm{BEP}) < \mathrm{MEAN\_BEP} + 0.6$

This means that in the logarithmic scale, MEAN_BEP is very close to the *worst* burst. Thus, when CV_BEP is large, some bursts are slightly worse than MEAN_BEP, while others are significantly better.

Figure 4 shows the throughput surfaces from Figure 3 viewed in the direction of the MEAN_BEP axis. In these plots the dependence on CV_BEP is evident. The schemes with lower code rates, MCS-5, MCS-6 and MCS-7, achieve higher throughput for larger CV_BEP since they benefit from that some of the bursts are better than others. This can also be seen in Figure 3. Note though that even if the overall gain is relatively larger for e.g. MCS-5 than for MCS-6, MCS-5 has almost already reached its peak rate[1] at the switching limit, whereas MCS-6 of course has not. Therefore the switching limit bends towards MCS-5. Also for the uncoded scheme MCS-9, a large CV_BEP has a positive effect on the throughput. This is since when some of the burst BEP values are better than the others, often only one of the two RLC blocks is corrupted. This effect can also be seen for the lightly coded MCS-8 and for MCS-7.

[1] This is probably due to that the MEAN_BEP and CV_BEP are not averaged or filtered before deriving the waterfall curves of Figure 2, Figure 3 and Figure 4.

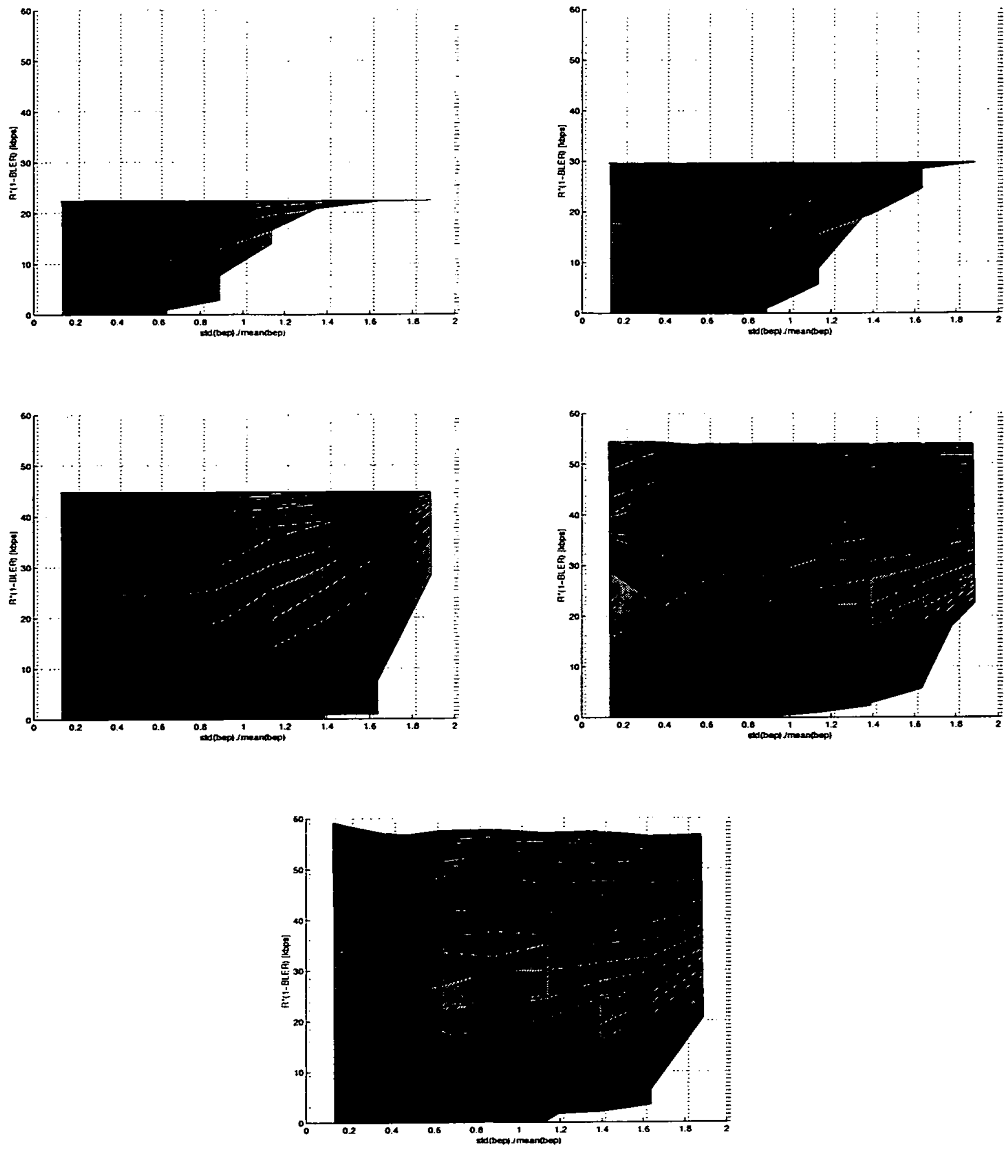

Figure 4. Throughput versus CV_BEP for MCS-5 (top left), MCS-6 (top right), MCS-7 (middle left), MCS-8 (middle right) and MCS-9 (bottom). These plots are side views of the throughput surfaces in Figure 3.

To further clarify the properties of MEAN_BEP, let us analyse what happens if the mean of the logarithm of the burst BEP values is used instead of, as proposed, the logarithm of the linear mean. Thus, consider Figure 5, where throughput is plotted versus mean($\log_{10}$(BEP)) and CV_BEP. Now, the throughput for the schemes with low code rates depend less on the CV_BEP, while the lightly coded schemes *lose* in throughput for increasing CV_BEP. This is since the burst BEP values now are evenly spread around mean($\log_{10}$(BEP)) (in the logarithmic scale). With strong channel coding, this is not a problem, but a large spread does not yield much gain either. The interleaving gain indicated by a large CV_BEP is counteracted by the bad bursts. On the other hand, with little or no coding, the throughput now degrades due to the bursts with higher BEP than the average. The conclusion of this is that the worst bursts of a radio block have a large impact on the throughput. Therefore, the proposed definition of MEAN_BEP is better than mean($\log_{10}$(BEP)).

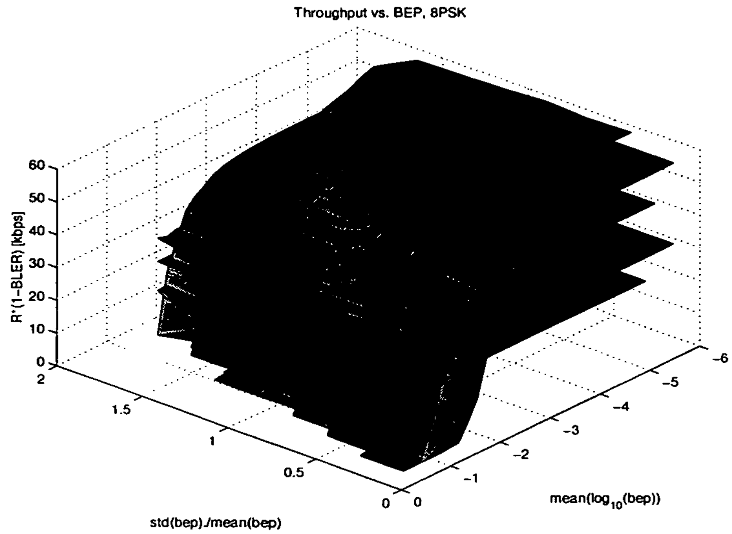

Figure 5. Throughput versus mean($\log_{10}$(BEP)) and CV_BEP for MCS-5 to MCS-9. Clearly, mean($\log_{10}$(BEP)) has disadvantages compared to MEAN_BEP.

2.2.1 Invariance to Speed, Dispersion and Frequency Hopping

In this section, it is shown that the mapping from MEAN_BEP and CV_BEP to BLER (and hence to throughput) is very similar regardless of the channel. Three properties are studied: invariance to frequency hopping, invariance to dispersion and invariance to speed.

Simulations were run with two extremes for each property; no frequency hopping versus ideal frequency hopping, TU channels versus HT channels and 3 km/h versus 100 km/h. This gives in total eight cases. For each case, 320000 bursts were simulated. MEAN_BEP and STD_BEP were calculated for each radio block. In the study of one channel property, the cases were grouped into two subsets, corresponding to the two values of the property. MEAN_BEP and STD_BEP for all radio block in each subset were used together with block error logs to derive mappings from MEAN_BEP and STD_BEP to BLER for the two subsets. To achieve good confidence, the two mappings were plotted only in points (i.e., slots in the quantised (MEAN_BEP,STD_BEP) surface) where at least 200 samples existed for each mapping. Simulations were run for MCS-5 and MCS-9.

In Figure 6 the BLER surfaces for MCS-5 with and without frequency hopping are compared. They are almost identical. The corresponding results for MCS-9 are shown in Figure 7. Figure 8 and Figure 9 show results for different time dispersion, while Figure 10 and Figure 11 give the results from the speed simulations. In none of the cases, the average distance between the two compared surfaces is more than a few percent (0.5 to 6 percent) in the direction of the BLER axis.

The conclusion is that MEAN_BEP and CV_BEP together give accurate information about the BLER for various channel situations.

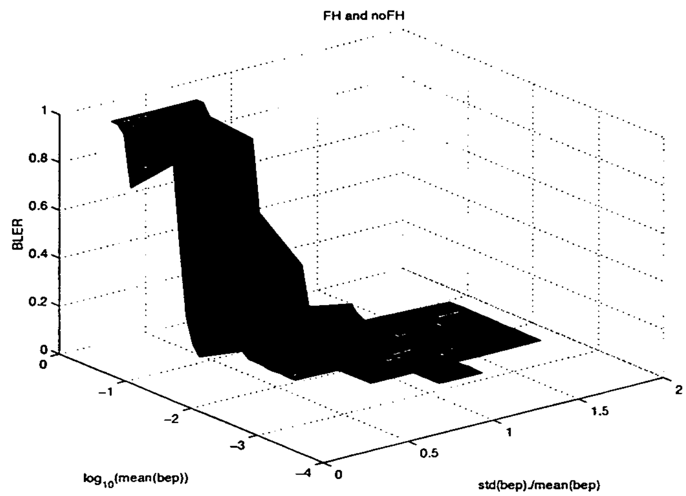

Figure 6. BLER versus MEAN_BEP and CV_BEP for MCS-5 with and without FH.

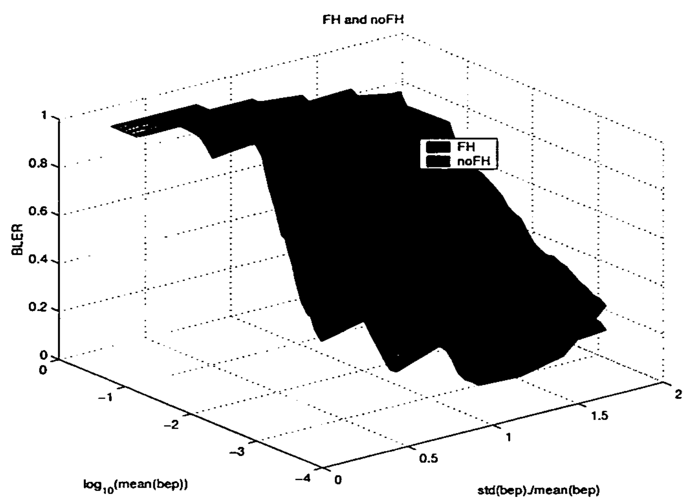

Figure 7. BLER versus MEAN_BEP and CV_BEP for MCS-9 with and without FH.

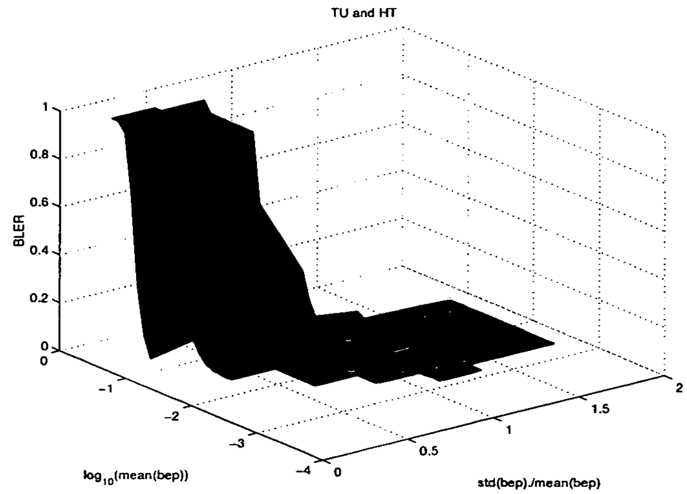

Figure 8. BLER versus MEAN_BEP and CV_BEP for MCS-5 on TU and HT channels.

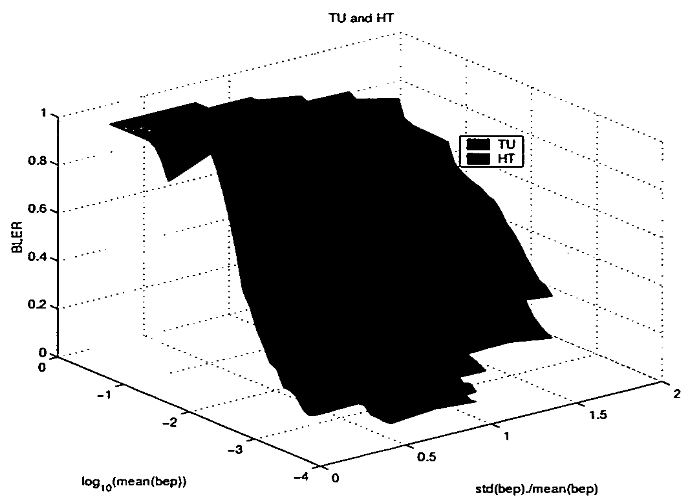

Figure 9. BLER versus MEAN_BEP and CV_BEP for MCS-9 on TU and HT channels.

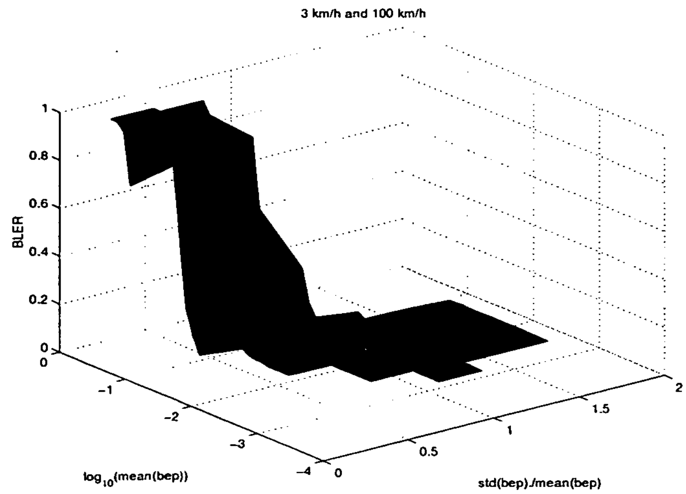

Figure 10. BLER versus MEAN_BEP and CV_BEP for MCS-5 at 3 km/h and 100 km/h.

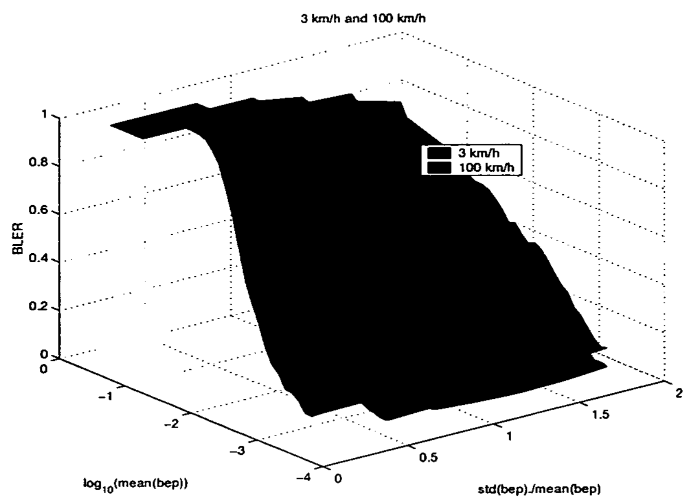

Figure 11. BLER versus MEAN_BEP and CV_BEP for MCS-9 at 3 km/h and 100 km/h.

3 Relation between GMSK BER and 8PSK BER

When selecting the appropriate MCS to use, the expected performance (e.g., throughput) for each MCS should be estimated. If the BEP of the prevailing modulation is estimated as described above, the BEP of the other modulation is not known. Hence, if both modulations have not been used, the expected performance of the MCS-1 to 4 has to be based on 8PSK BEP estimates, or the performance of MCS-5 to 9 has to be estimated based on GMSK BEP measurements.

The relation between the GMSK BER and 8PSK BER depends on several parameters:

1. The channel type
2. The average power decrease (APD) of the 8PSK modulation

3. The implementation of the GMSK and 8PSK receivers

The BS has knowledge of parameters 1 (the time dispersion is the same in both up- and downlink) and 2 but not 3. The MS knows parameters 1 and 3 but not 2 (since it varies with time depending on the mobile's position in the cell).

The relation is depicted in **Error! Reference source not found.** for different channels and receivers. In these simulations an MLSE is used for GMSK. For 8PSK, one simple and one more advanced receiver are used[2]. As can be seen, the simulation results verify that the BER relation depends on both parameters 1 and 3 (that it is affected by the APD is quite obvious).

Since neither the MS nor the BS knows all the parameters, the question where the BEP mapping shall be performed arises. In earlier versions of this paper [4], it was proposed that one bit should be appended to the measurements when reporting GMSK BEP to indicate that the 8PSK BEP is expected to be below some certain threshold. This can be seen as a simple mapping performed by the MS.

However, besides from being a rather rough mapping, this method has some other drawbacks. Firstly, the APD can not be known in the MS. Secondly, it causes MS complexity since additional estimations of dispersion etc. are needed.

Further, for receivers fulfilling the performance requirements that are expected to be specified in spec. 05.05, the dependence on receiver implementation is probably smaller than indicated by **Error! Reference source not found.** (the simple 8PSK receiver in the simulations does not fulfil the performance requirements since it gives poor performance on time dispersive channels). Even if other even more sophisticated receivers are used for 8PSK, the difference is expected to be smaller.

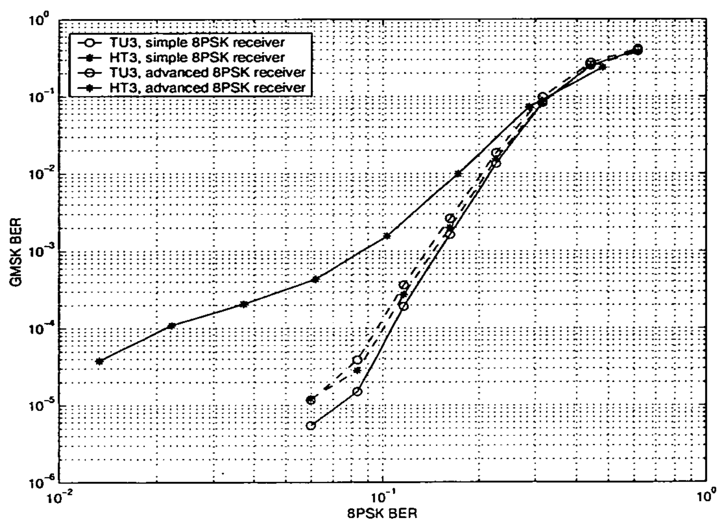

Figure 12. Relation between GMSK and 8PSK BEP for different time dispersions and different receiver complexity.

Taking this into account, it is proposed that no mapping between the BEP mean and CV of the two modulations is performed in the MS. If one modulation has been used exclusively since the last measurement report, only the MEAN_BEP and CV_BEP of that modulation is reported by the MS. In this case, the mapping is performed in the BS, supported by e.g., measurements on the uplink

2 The simple receiver does not fulfil the requirements that are expected to be specified in spec. 05.05. It is included in the simulations only for comparison.

channel and knowledge of the APD. On the other hand, when at least one block has been received[3] for each modulation since the last report was sent (e.g., when retransmissions and new transmissions are mixed), MEAN_BEP and CV_BEP should be reported for both modulations.

A measurement report structure is given in section 6 (also given in CR 04.60-A446 [6] approved by SMG2 #32).

4 Optional per-slot BEP Measurements

Although the interference situation may differ between the different time slots, the radio conditions (i.e. time dispersion, velocity, attenuation etc) are basically the same. IR is mandatory for the mobiles and the reported measurements must thus not always have to be so detailed that they characterise the quality of each slot individually. Thus, it is proposed that the MEAN_BEP and CV_BEP are averaged[4] over all slots of the TBF before filtering. Note that this still allows differentiation of flows with different quality of service profiles for the same user, since they will use different TBFs.

However, in some cases it may be beneficial to allow per slot quality measurements, e.g., for slot reallocations in a system without frequency hopping. Therefore it is proposed that the I_LEVEL fields occasionally can be replaced by per-slot BEP measurements. This should be under network control, and signalled with one bit in the PACKET DOWNLINK ASSIGNMENT message. For this purpose, it is expected that a lower granularity is required for the MEAN_BEP. Therefore only the three most significant is reported in this case. Further the CV_BEP is expected to be similar for all slots and does not need to be reported individually. Finally, to save space it is proposed that the modulation of the last received block on each slot determines the reported modulation. As for the averaged measurements, the per-slot measurements should also be per TBF, to allow differentiation of different flows.

This can be especially advantageous for EDGE compact, where I_LEVEL measurements can not be done in the currently standardised way.

A report structure is proposed in section 6 (also given in CR 04.60-A446 [6] approved by SMG2 #32).

5 Filtering of the Measurements

MEAN_BEP and CV_BEP are separately filtered for a sequence of blocks in the mobile. One value per parameter (and, if possible, per modulation) is reported in the uplink control blocks.

As widely used for other filtering purposes in GSM, a simple parameterised exponential filter could be used. The filter is characterised by its averaging period (or equivalently its forgetting factor). This parameter should be broadcast in the cell, preferably in PACKET SYSTEM INFORMATION 1. It is expected that 3 bits are enough for coding the averaging period.

Possible values of the forgetting factor are given in Table 1. Note that the proposed range is very preliminary and needs to be studied further.

Bit pattern	Value of the forgetting factor
000 (0d)	0.9 (fast filter)
001 (1d)	0.7

[3] Demodulated and identified as addressed to the polled receiver.

[4] The averaging should be made over concurrent blocks (i.e., over all time slots of the TBF) before filtering.

010 (2d)	0.5
011 (3d)	0.3
100 (4d)	0.1
101 (5d)	0.05
110 (6d)	0.03 (slow filter)
111 (7d)	reserved

Table 1. Values of the forgetting factor.

6 Measurement Reporting

As in GPRS, the link quality measurements should be included in the uplink control blocks. In GPRS the following quality reports exist:

- RxQual, 3 bits
- Signal Variance, 6 bits

These should be replaced by:

- MEAN_BEP
- CV_BEP

The results in section 2 show that 5 bits for the MEAN_BEP and 3 bits for the CV_BEP is enough.

If it is desired to still obtain RxQual values, e.g. for existing power control algorithms, the MEAN_BEP can simply be mapped to RxQual in the network, since they both measure the average BER. Signal Variance was introduced in GPRS to support LA, and the functionality can now be replaced by CV_BEP in EGPRS.

The MEAN_BEP should be calculated as a linear mean of the burst BEPs, and reported in a logarithmic scale. As seen in Figure 2 and Figure 3, the interesting range to cover is $10^{-3.4}$ - $10^{-0.3}$ (=0.5). A proposal for intervals to report is given in Table 2.

From Figure 2 and Figure 3 it is seen that the interesting CV_BEP range to cover is 0 to 2 (note that CV_BEP can not have values outside this range). A proposal for intervals to report is given in Table 3.

Bit pattern	Range of $\log_{10}$(mean(BEP))
00000 (0d)	-0.3 - -0.4
00001 (1d)	-0.4 - -0.5
00010 (2d)	-0.5 - -0.6
...	...
11101 (29d)	-3.2 - -3.3
11110 (30d)	-3.3 - -3.4

11111 (31d)	<-3.4

Table 2. Bit pattern mapping proposal for mean BEP

Bit pattern	Range of CV_BEP
000 (0d)	0.00 - 0.25
001 (1d)	0.25 - 0.50
010 (2d)	0.50 - 0.75
011 (3d)	0.75-1.00
100 (4d)	1.00 - 1.25
101 (5d)	1.25 - 1.50
110 (6d)	1.50-1.75
111 (7d)	1.75-2.00

Table 3. Bit pattern mapping proposal for the coefficient of variation of BEP

6.1 Reporting Formats

The measurement report will contain the following structure

```
< EGPRS Channel Quality Report > ::=
        < EGPRS BEP Link Quality Measurements : <EGPRS BEP Link Quality
Measurements IE >>
        < C_VALUE : bit (6) >
{ 0 < EGPRS Timeslot Link Quality Measurements : <EGPRS Timeslot Link Quality
Measurements IE >>
| 1             { 0 | 1 < I_LEVEL_TN0 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN1 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN2 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN3 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN4 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN5 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN6 : bit (4) > }
                        { 0 | 1 < I_LEVEL_TN7 : bit (4) > } };
```

where EGPRS BEP Link Quality Measurements IE contains the quality averaged over all slots.

```
<EGPRS BEP Link Quality Measurements IE> ::=
{ 0 | 1< GMSK_MEAN_BEP_AV : bit (5) >
      < GMSK_CV_BEP_AV : bit (3) >}

{ 0 | 1 < 8PSK_MEAN_BEP_AV : bit (5) >
        < 8PSK_CV_BEP_AV : bit (3) >}
```

GMSK_MEAN_BEP_AV, **GMSK_CV_BEP_AV**, **8PSK_MEAN_BEP_AV** and **8PSK_CV_BEP_AV** are the averaged and filtered parameters. This structure has a maximum length of 18 bits, but is typically limited to 10 bits.

Further, EGPRS Timeslot Link Quality Measurements IE is the quality per timeslot.

```
<EGPRS Timeslot Link Quality Measurements IE> ::=
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN0 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN0 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN1 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN1 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN2 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN2 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN3 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN3 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN4 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN4 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN5 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN5 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN6 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN6 : bit (3) >}}
{ 0 | 1 { 0 <GMSK_MEAN_BEP_TN7 : bit (3) >
            | 1 < 8PSK_MEAN_BEP_TN7 : bit (3) >}};
```

GMSK_MEAN_BEP _TNx and **8PSK_MEAN_BEP_TNx** are the mean BEP estimations on timeslot x for GMSK and 8PSK, respectively. This structure has a maximum length of 40 bits.

7 Conclusions

It is proposed that the mobile stations measure and report the mean(BEP) and std(BEP)/mean(BEP). The BEP should be estimated on burst basis, and the mean and the coefficient of variation are obtained on radio block basis.

A deeper analysis of the proposed measures is provided. The ability to predict BLER from the measures is demonstrated by means of simulations. The conclusion is that mean(BEP) and std(BEP)/mean(BEP) together give accurate information about the BLER for various channel situations.

The two parameters should be individually filtered before reporting. An exponential filter is proposed. The averaging period should be broadcast in the cell. In multislot operation, the measurements are averaged over all slots.

The necessary resolution in the report is 5 bits for the mean and 3 bits for the coefficient of variation. The proposed range is $10^{-3.4}$ to $10^{-0.3}$ (=0.5) for mean(BEP) and 0 to 2 for std(BEP)/mean(BEP).

Furthermore it is proposed that measurements are reported for the modulations for which blocks have been received. If measurements for only one modulation is reported, the performance of the other modulation is estimated in the BS.

Optionally, per-slot BEP measurements can be reported by replacing the I_LEVEL fields by BEP measurements in the measurement report. This is controlled by the network by signalling with one bit in the PACKET DOWNLINK ASSIGNMENT message. To reduce the number of bits, the coefficient of variation is not reported per slot. Further, the granularity of mean(BEP) per slot is reduced from five to three bits, and only measurements for one modulation is included.

In order to complete a CR for 05.08, ranges for the measurement filter parameter and accuracy requirements for the BEP measurements must be agreed on.

8 References

[1] Tdoc SMG2 EDGE 006/99, “EGPRS Concept”

[2] Tdoc SMG2 EDGE 038/99, “Link Quality Control Aspects for Mobile Testing”

[3] Tdoc SMG2 464/99, “Link Quality Control Measurements for EGPRS”

[4] Tdoc SMG2 EDGE 199/99, “Link Quality Control Measurements for EGPRS”

[5] Tdoc SMG2 1260/99, “Variability Metrics for EGPRS”

[6] Tdoc SMG2 1025/99,”CR 04.60-A446”